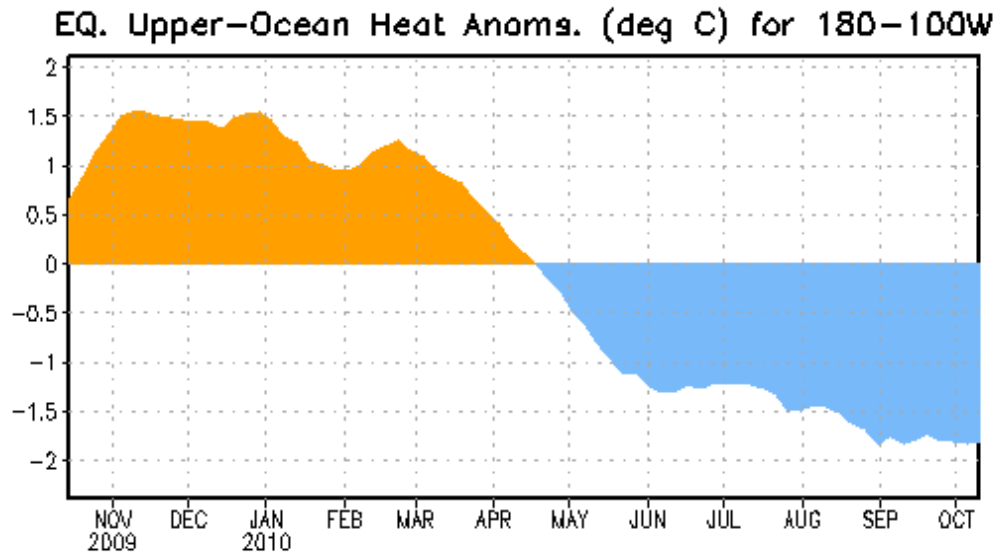


## **Winter Outlook for the Blacksburg/Roanoke County Warning Area**

After the snowy winter of 2009-2010 many people in our area may be wondering what the winter of 2010-2011 has in store for the Blacksburg/Roanoke County Warning Area (CWA). The Climate Prediction Center (CPC) of the National Weather Service (<http://www.cpc.ncep.noaa.gov/>) is responsible for producing the longer-range forecasts out to a range of one year for the entire U.S. Every month the CPC updates these forecasts using a variety of predictive tools to make scientifically sound forecasts on precipitation and temperature.

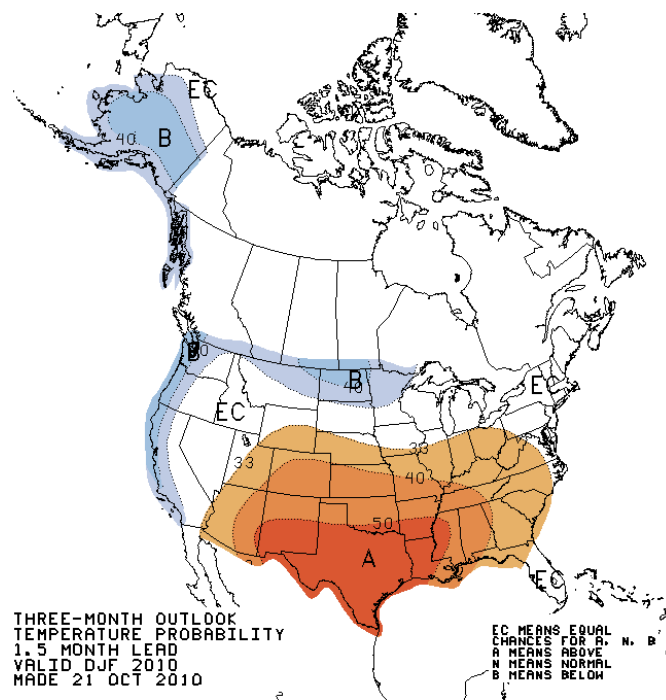
Before discussing the actual forecast it may help to understand what factors are considered in making these forecasts. The main tools are: 1) Computer models of the earth-atmosphere system; 2) Statistical analysis of existing and forecast meteorological patterns; 3) State of the El Niño/Southern Oscillation (ENSO); 4) Trends in climate normals; 5) Soil moisture analogs; 6) Single-station statistical methods. Various predictive tools may have more or less skill at different seasons or locations in the U.S. and depending on the strength of a particular signal.

For wintertime in the southern Appalachian/mid-Atlantic region which our CWA falls into, the most accurate long-range forecasts tend to be those driven by a strong ENSO signal, whether that is El Niño or La Niña. The winter of 2009-2010 was dominated by a strong El Niño event with warm Pacific Ocean temperature anomalies reaching  $+1.8^{\circ}\text{C}$  (using the Oceanic Niño Index or ONI) in the November-January time frame. This was the strongest El Niño since the record-setting 1997-1998 ( $+2.5^{\circ}\text{C}$ ) event. The past six-month period however has seen some of the most dramatic changes in the equatorial Pacific Ocean heat content since these types of records have been kept (essentially since the early 1950s). Beginning in April and accelerating through May the oceanic heat content has completely reversed itself and as of mid-October a fairly strong La Niña has developed (see Fig. 1). The ONI as of mid-October (July-September average) has fallen to  $-1.0^{\circ}\text{C}$ , with the threshold for a La Niña of  $-0.5^{\circ}\text{C}$ . For this to qualify as a full-blown La Niña this temperature anomaly will have to persist for 5 consecutive overlapping seasons. By another measure called the Southern Oscillation Index (SOI), this La Niña is already quite strong. According to the Australian Bureau of Meteorology the SOI value of +25 for September is the strongest since 1973 and this value puts it in the top 5% of observed SOI values. However, it is quite unusual to transition from a strong El Niño to a strong La Niña within one season and the effects on our weather of this rapid transition are uncertain.



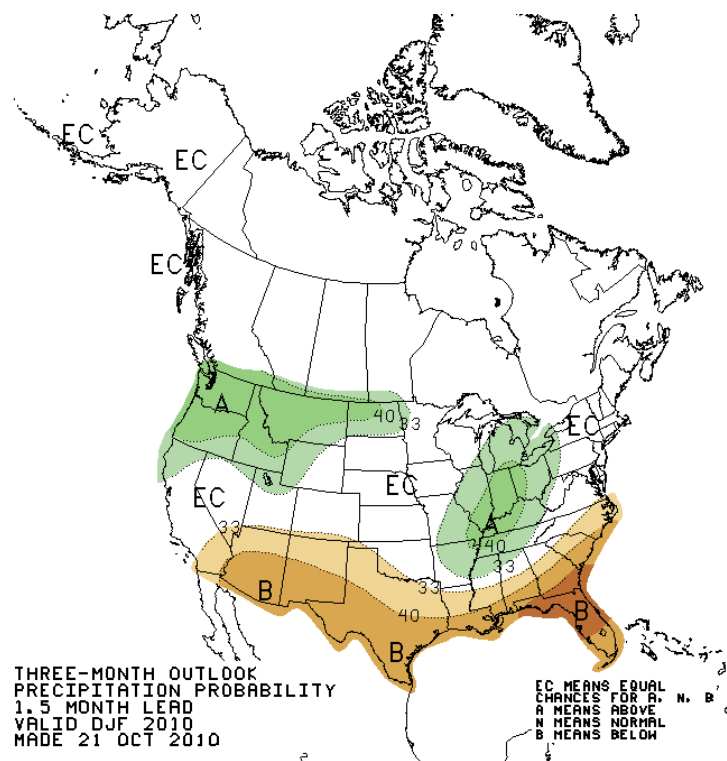
**Figure 1 - Equatorial Pacific Ocean Heat Content Anomalies (October 18, 2010)**

So with a La Niña event already well entrenched and nearly all forecast models from around the world predicting its perseverance into the spring of 2011, what impact can we expect on the local weather this winter? According to the latest Climate Prediction Center (CPC) forecast, issued on October 21 somewhat warmer temperatures are likely across the southern one-half of the United States in the December-February period (see Figure 2).



**Figure 2 - December-February U.S. Temperature forecast**

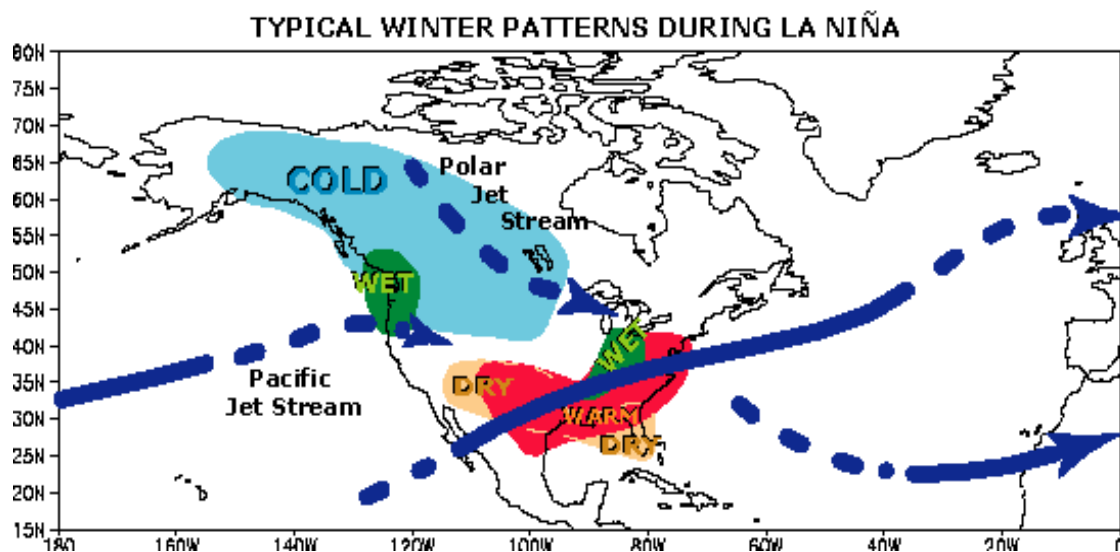
The above normal area covers most of the southern and central U.S. with the greatest likelihood of above normal temperatures over the southwestern U.S. from New Mexico eastward into Mississippi. In this area the '50' line indicates a 50 percent chance or greater that the average temperature over the 3-month period will be in the above normal tercile of temperature. A tercile represents one-third of the values in the climatological record period (1971-2000). For statistical purposes, this temperature record can be divided into 3 equal terciles; above, normal and below. For the Blacksburg CWA then, the forecast is for slightly above a 33 percent chance (roughly 35-38 percent) of the average temperatures for the entire winter season falling into the highest tercile. The precipitation forecast is even more uncertain, as seen in Figure 3, which shows the entire area falling within the "Equal Chances" (EC) tercile.



**Figure 3 - December-February U.S. Precipitation forecast**

Figure 4 below shows a schematic how a typical La Niña winter affects North America. The higher precipitation over the Ohio Valley is usually due to a more active storm track across that region. Reduced precipitation along the southeastern U.S. coast is due to fewer low pressure centers developing over the Gulf of Mexico and tracking toward the Carolina coastline. One only has to go back to the winter of 2007-2008 for a possible analog (similar season and pattern) to what we may expect this coming winter. That winter a fairly strong (-1.4°C ONI) La Niña was in place and overall winter temperatures were well above normal, running generally 2 to 4 degrees (F) above the 30-year mean. For several of our local climate stations the winter ranked in the top 10 warmest on record and was the warmest yet recorded at Bluefield, WV. The predominant storm track was across the Ohio Valley bringing above normal precipitation to that area and warmer temperatures along the southeast U.S.

coast extending back into the Appalachian Mountains. It remains to be seen whether the current La Niña will reach the same strength as the 2007-2008 version, which could have an impact on how things develop this winter. However, a local office study recently conducted looking at fairly strong La Niña winters immediately following El Niño summers (similar to this year) suggested a very good chance for above normal temperatures in the December-February time frame. The warmest month relative to normal was January with a tendency for cooler temperatures to occur later in the winter season (February). Precipitation under these types of scenarios was below normal but highest in our western CWA closer to the dominant Ohio Valley storm track.



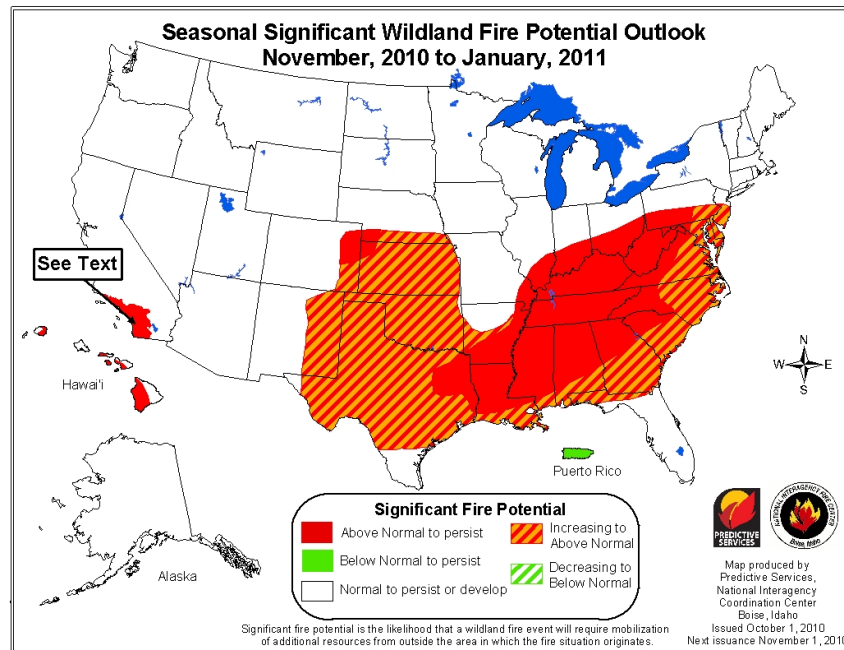
**Figure 4 - Typical North American Winter Patterns during La Niña.**

So the big question for local winter weather lovers (and haters!) is how much snow will we get this winter? The average annual snowfall in inches for the five climate observing sites in our CWA is as follows, along with last year's amount in parentheses:

- Lynchburg - 15.3 (34.8)
- Roanoke - 21.3 (43.1)
- Blacksburg - 22.5 (53.6)
- Bluefield - 32.0 (81.1)
- Danville - 9.2 (13.4)

During the La Niña winter of 2007-2008 discussed above however, snowfall ranged from only 2.1 inches (Lynchburg) to 14.0 inches (Bluefield) with the other stations falling somewhere in between. So, one could reasonably forecast that our snowfall numbers for this coming winter will be much closer to the 2007-2008 values than the extraordinary numbers reached in 2009-2010. Although snowfall is likely to be below normal, the possibility for significant ice storms may actually be enhanced somewhat by this expected pattern with more opportunities for cold-air damming scenarios.

One of the biggest impacts of the La Niña winter of 2007-2008 was the increased fire danger due to the combination of below normal precipitation, especially low snowfall, and above normal temperatures. The February 10, 2008 wildfire was one of the largest recent wildfire outbreaks in Virginia coming at the tail end of the warm and almost snowless La Niña winter of that year. As a result of these same factors being in place, the National Fire Interagency Coordination Center in Boise, ID is suggesting that there is an above normal chance for significant wildfires across our entire region (see Figure 5 below).



**Figure 5 – U.S. Wildland Fire Potential Outlook**